

No. 7.—Block of Bramley Fall stone.

Pressure. Effect.
Tons.
75 No perceptible effect.

No. 8.—A block of concrete stone (for description see below) 48 days old.

Pressure. Effect.
Tons.
22.5 Cracked.
24.375⁶ Gave for all practical purposes.
30 Broke up.

This block was composed of pieces of Portland rubble stone, cemented together with Portland cement and sand in proportion of one part cement to two parts sand. The small block mown out of a larger one of 3 tons weight, which was cast in a mould.

No. 9.—A block of concrete stone, 70 days old.

Pressure. Effect.
Tons.
15 Scaled at corner.
16.875⁶ Crushed.

The same description applies to this block as the foregoing, with the exception that the cement was mixed with sand in parts of one cement to three sand.

No. 10.—A block of concrete stone, 270 days old.

Pressure. Effect.
Tons.
63.75 A pressure commencing at 11 tons, applied gradually until it reached 63.75 tons, without any perceptible effect. On the last weight being applied the block fell to pieces with a report, shewing equal fractures all through of cement and stone.

Description same in every respect as to No. 8, but this block was 9 months old.

Weight of concrete stone 135lbs. per foot cube.

No. 11.—A block composed of Portland cement 1 part, and sand 2 parts. 52 days old.

Pressure. Effect.
Tons.
37.5 Slightly cracked at one corner.
37.5 No further effect.
45 Cracked throughout suddenly, not practically injured till the last weight was applied.

This block was steeped in water for 7 days very soon after it was made. Weight before steeping 106½lbs.; weight after steeping 107½lbs.; gain in that time 1 per cent.

No. 12.—Block composed of Portland cement, 1 part, sand 3 parts. 52 days old.

Pressure. Effect.
Tons.
15 Slightly cracked at one corner.
25 Broke up suddenly.

Steeped in water as No. 11. Weight before steeping, 104 lbs.; ditto after ditto, 105½ lbs.; gain in that time, 1½ per cent.

Weight per foot cube of Nos. 11 and 12, 127 lbs.

No. 13.—Block composed of Roman cement, 1 part, sand 2 parts. 52 days old.

Pressure. Effect.
Tons.
Went to pieces before 3 tons' weight was fairly upon it.

Steeped in water as Nos. 11 and 12. Weight before steeping, 100 lbs.; ditto after ditto, 105 lbs.; gain in that time, 5 per cent.
Weight 120 lbs. per foot cube.

No. 14.—Block composed of Portland cement, 1 part; shingle 10 parts.

Pressure. Effect.
Tons.
7.5 Cracked at one corner.
10⁶ Crushed.

Weight 139 lbs. per foot cube.

No. 15.—Block of White and Sons' stock bricks, set as a 9 inch pier, with Portland cement, 1 part; sand 2 parts. 52 days old.

Pressure. Effect.
Tons.
16.875 Slightly going.
22.5 Crushed.

At 22½ tons is 608 lbs. per square inch, 39.5 tons per square foot.

* At 24 tons crushing weight is 611lbs. per square inch, 48.6 tons per square foot.

† At 16 tons is 447lbs. per square inch, 28.4 tons per square foot.

‡ At 60 tons is 1,660lbs. per square inch, 106.6 tons per square foot.

§ At 45 tons pressure is 1,214lbs. per square inch, 80 tons per square foot.

|| At 35 tons pressure is 691 lbs. per square inch, 44.4 tons per square foot.

¶ At 3 tons is 83 lbs. per square inch, 5.4 tons per square foot.

** At 10 tons is 276 lbs. per square inch, 17.7 tons per square foot.

No. 16.—Block of bricks as above, set with

Roman cement, 1 part; sand, 2 parts. 52 days old.

Pressure. Effect.
Tons.
5.625 Cracked, owing to bad brick.
14.062⁶ Crushed.

The 5 experiments on brick give 22 tons as the average resistance to crushing of a 9-inch pier.
Weight, 104 lbs. per foot cube.

Comparison of the relative strength of Portland and Roman Cement, as shewn by the annexed statement:—

1. *Blocks of Concrete Stone*, Nos. 8, 9, 10, Table 1.—Attained at the age of six weeks, the average strength of bricks, viz., 24 tons, upon a 9-inch area, or 42 tons per square foot; while at nine months old, a power of 63 tons per 9-inch area, or 106 tons per square foot, is required to crush the concrete stone, shewing it to be but little inferior to the best Portland stone.

2. *Bricks*, No. 3, 4, 5, 15, 16, Table 1.—The greatest resistance in these five experiments found to be 30 tons, and the average resistance 22 tons—giving about 600 lbs. per square inch, or 38 tons per square foot, as the strength of brickwork in cement. Owing to the bricks giving way in each case before the cement, the peculiar properties of Portland cement were not elicited in these experiments.

3. *Blocks composed of Cement with Sand*, Nos. 1, 2, 11, 12, 13.—

	Tons.
No. 1. Portland cement neat, not crushed at the whole power of the press—(this block in possession of Mr. Rendel)	75
11. Portland cement one part, sand two parts, crushed	45
12. Ditto one part, sand three parts, crushed	25
2. Roman cement neat, crushed	27
13. Roman cement one part, sand two parts, crushed	3

Shewing a superiority in strength of neat Portland cement over neat Roman cement of 3 to 1; of Portland cement and two sands, over Roman and two sands, of 15 to 1; and of Portland cement and three sands, over Roman and three sands, of 5 to 1.

Assuming three parts sand as the proper quantity to mix with Portland cement for building purposes, a connecting power is gained three times stronger than that given by one Roman cement and one sand (the proportion usually adopted), at no increase in the cost.

	s. d.	Per bushel.
Thus, assume the price of Portland cement, at per bushel	2	6
Three bushels sand, at 3d. ditto	0	9
	4) 3	3 (9d.
Roman cement, at per bushel	1	3
One bushel sand	0	3
	2) 1	6 (9d.

TRUSSED IRON GIRDERS.

SIR,—Having noticed in your last week's paper an account of some experiments with a girder made at Mr. Cubitt's works, I beg to suggest an explanation of the causes which produced the difference in their results, and also to lay down a rule for the guidance of those who think proper to employ tension trusses to girders.

The principle of the tension rods being to counteract, by their elastic strength, the elongation of the lower part of the girder, which takes place by deflection, it follows that if the line ABBA is shortened, by the points AA being brought nearer together by the deflection of the girder, they will, instead of counteracting, add a portion of the power that has been applied in tightening them to the deflection and consequent weakening of the girder.

When girders are deflected by transverse strains, the upper portion is compressed, and the lower extends.

The line in which these strains meet is termed the neutral axis, which in the girder under experiment would be about 2½ inches

* At 14½ tons is 360 lbs. per square inch, 25.7 tons per square foot.

from the upper edge, and it will be found in experiment No. 1 that a deflection of 2½ inches would, by bringing the points AA nearer together, make the line ABBA shorter than when the girder was in a state of rest.

In experiment No 2 the length of the line ABBA would remain unaltered, and in Nos. 3, 4, 5, 6, and 7 the deflection of the girder would produce an elongation of the tension rods, and consequently bring their elastic force into operation, the tension rods strengthening the girder in the proportion of their elongation, by its deflection.

To produce the greatest effect, the points AA should be below the neutral axis of the girder, and the points BB, as much below the bottom of the girder as is practicable, for A being a given point, the less the angle ABB, the greater will be the strength of the girder.

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RAILWAY JOTTINGS.

In a few notes of progress, thrown together under the head of "The Atmospheric Systems," allusion was made to Messrs. Clarke and Varley's patent elastic slit tube or valve for the atmospheric exhaustive system. Mr. Clarke, in pointing our attention to the fact that in this invention there is really no valve properly speaking, informs us that the tube is not made of steel, but "of wrought-iron plates rolled into cylindrical form, with the edges truly planed." The longitudinal opening of these "air-tight metallic lips" is effected by the piston-rod in transit, the friction of which, according to Mr. Clarke's statement, does not exceed 5 per cent. of the power employed, while the closure of the valve or tube is accomplished by its own elasticity and the outer atmospheric pressure. Once made air-tight, the longer the edges wear by the friction, the more true, he says, they will become. The piston-leather is the only non-metallic substance about this invention; and probably not the least of its advantages is, that the sealing composition, whose repeated failures from the outset tended so much to excite our misgivings of success with the longitudinal valve, is in this case thrown aside altogether. "In reference to the various plans of atmospheric propulsion before the public," adds Mr. Clarke, "there is one point of great importance not provided for in many of them, and which was not noticed in the article alluded to [the main object of which was merely to record progress]: In admitting air to the piston, the opening in the tube immediately behind it should be equal to its area, that the air may not have to follow through the tube but flow therein with its full and regular power: this, in our plan, is amply provided for. In drawing a comparison between compressed and exhausted air, I would just observe, that in the former case a long column of dense air has to be kept in rapid motion, both before and behind the piston; involving enormous friction; while, in the latter, the air in motion is only in front of the piston and in a rarified state, the atmosphere behind dropping in without friction as the piston advances."—At the Paris Academy of Sciences, M. Ferdinand, engineer, lately proposed to construct a floating tunnel from Calais to Dover, for the wires of the electric telegraph, and large enough to be traversed by small locomotives, for the conveyance of passengers. The plan was referred to one of the members for examination.—The Oxford, Worcester, and Wolverhampton line is to be opened between Abbot's Wood and Worcester, before the Worcester music meeting takes place. The works on the main line are now making steady progress. The cuttings and levellings on the whole line between Worcester and Stourbridge are completed, except near Oldswinford; and the Dudley tunnel is approaching completion. The bridge, over the line at the Dudley station, which partially fell down some time ago, has been repaired.—At the Guide-bridge station, on the Manchester, Sheffield, and Lincolnshire line, a short tunnel had been in an imperfect state, and the engineer having advised its removal, the workmen lately took down the arch, and completed a bridge in its stead; but in shifting the fallen materials, a portion of the wall or abutment